```
=> d his ful

     (FILE 'HOME' ENTERED AT 16:54:06 ON 03 JAN 2007)

     FILE 'HCAPLUS' ENTERED AT 16:59:48 ON 03 JAN 2007
                E SEIBERT MICHAEL/AU
L1           138 SEA ABB=ON  "SEIBERT MICHAEL"/AU
                E MAKAROVA VALERIYA/AU
L2             3 SEA ABB=ON  ("MAKAROVA VALERIA"/AU OR "MAKAROVA VALERIYA"/AU)
                E TSYGANKOV ANATOLY A/AU
L3            23 SEA ABB=ON  ("TSYGANKOV ANATOLY"/AU OR "TSYGANKOV ANATOLY
                A"/AU)
                E RUBIN ANDREW B/AU
L4            14 SEA ABB=ON  ("RUBIN ANDREW"/AU OR "RUBIN ANDREW B"/AU)
L5             1 SEA ABB=ON  L1 AND L2 AND L3 AND L4
L6               ANALYZE L5 1-1 CT :      11 TERMS

     FILE 'REGISTRY' ENTERED AT 17:56:17 ON 03 JAN 2007
L7             1 SEA ABB=ON  HYDROGEN/CN
L8             1 SEA ABB=ON  SULFUR/CN
                E CHLORELLA VULGARI/CN
L9             1 SEA ABB=ON  "CHLORELLA VULGARIS, EXT."/CN
                E SCENEDESMUS OBLIGUUS/CN
                E CHLAMYDOMONAS/CN
L10            3 SEA ABB=ON  ("CHLAMYDOMONAS REINHARDI ENDONUCLEASE A"/CN OR
                "CHLAMYDOMONAS REINHARDII EXONUCLEASE 1"/CN OR "CHLAMYDOMONAS
                REINHARDTII METALLOPROTEINASE"/CN)

     FILE 'HCAPLUS' ENTERED AT 17:59:04 ON 03 JAN 2007
L11       330888 SEA ABB=ON  (L7 OR ?HYDROGEN?)(5A)(?PROD? OR ?PREP? OR
                ?MANUF?) OR ?ANAEROB?
L12          101 SEA ABB=ON  L11 AND (?MICROORG? OR ?ALGAL? OR ?ALGAE?)(W)?CULTU
                RE?
L13            4 SEA ABB=ON  L12 AND (?FLUOROMET? OR ?FLUORESC? OR ?ELECTROLUM?)
L14            1 SEA ABB=ON  L12 AND (?PHOTO? OR ?SIGNAL?)(W)?TRANSDUC?
L15            1 SEA ABB=ON  L12 AND (L8 OR ?SULFUR?)(5A)(?DEPLET? OR ?ABSENC?
                OR ?REMOV?)
L16            4 SEA ABB=ON  L13 OR L14 OR L15
L17           19 SEA ABB=ON  L12 AND (L9 OR L10 OR ?CHLAMYDOMONAS? OR ?SCENEDESI
                MUS? OR ?CHLORELLA?)
L18           19 SEA ABB=ON  L16 OR L17
L19            0 SEA ABB=ON  L18 AND ?ACTINIC?(W)?LIGHT?
L20            0 SEA ABB=ON  L19 AND ?ACTINIC?
L21            0 SEA ABB=ON  L19 AND (?MEAS? OR ?DETERMIN? OR ?ANAL?)(4A)(L7 OR
                ?HYDROGEN?)
L22           15 SEA ABB=ON  L18 AND (PRD<20041018 OR PD<20041018)

     FILE 'MEDLINE, BIOSIS, EMBASE, JAPIO, JICST-EPLUS' ENTERED AT 18:05:51 ON
     03 JAN 2007
L23           25 SEA ABB=ON  L18
L24           18 DUP REMOV L23 (7 DUPLICATES REMOVED)

     FILE 'USPATFULL, WPIDS' ENTERED AT 18:07:37 ON 03 JAN 2007
L25          223 SEA ABB=ON  L22
L26            7 SEA ABB=ON  L25 AND ?ACTINIC?

     FILE 'HCAPLUS, USPATFULL, WPIDS' ENTERED AT 18:09:26 ON 03 JAN 2007
L27           21 DUP REMOV L22 L26 (1 DUPLICATE REMOVED)
```

FILE HOME

FILE HCAPLUS

FILE COVERS 1907 - 3 Jan 2007 VOL 146 ISS 2
FILE LAST UPDATED: 2 Jan 2007 (20070102/ED)

New CAS Information Use Policies, enter HELP USAGETERMS for details.

This file contains CAS Registry Numbers for easy and accurate substance identification.

FILE REGISTRY
Property values tagged with IC are from the ZIC/VINITI data file provided by InfoChem.

STRUCTURE FILE UPDATES: 2 JAN 2007 HIGHEST RN 916646-22-5
DICTIONARY FILE UPDATES: 2 JAN 2007 HIGHEST RN 916646-22-5

New CAS Information Use Policies, enter HELP USAGETERMS for details.

TSCA INFORMATION NOW CURRENT THROUGH June 30, 2006

Please note that search-term pricing does apply when conducting SmartSELECT searches.

REGISTRY includes numerically searchable data for experimental and predicted properties as well as tags indicating availability of experimental property data in the original document. For information on property searching in REGISTRY, refer to:

http://www.cas.org/ONLINE/UG/regprops.html

FILE MEDLINE
FILE LAST UPDATED: 2 Jan 2007 (20070102/UP). FILE COVERS 1950 TO DATE.

All regular MEDLINE updates from November 15 to December 16 have been added to MEDLINE, along with 2007 Medical Subject Headings (MeSH(R)) and 2007 tree numbers.

The annual reload will be available in early 2007.

This file contains CAS Registry Numbers for easy and accurate substance identification.

FILE BIOSIS
FILE COVERS 1969 TO DATE.
CAS REGISTRY NUMBERS AND CHEMICAL NAMES (CNs) PRESENT FROM JANUARY 1969 TO DATE.

RECORDS LAST ADDED: 3 January 2007 (20070103/ED)

FILE EMBASE
FILE COVERS 1974 TO 3 Jan 2007 (20070103/ED)

EMBASE is now updated daily. SDI frequency remains weekly (default) and biweekly.

This file contains CAS Registry Numbers for easy and accurate substance identification.

FILE JAPIO
FILE LAST UPDATED: 2 JAN 2007 <20070102/UP>
FILE COVERS APRIL 1973 TO SEPTEMBER 29, 2006

>>> GRAPHIC IMAGES AVAILABLE <<<

>>> NEW IPC8 DATA AND FUNCTIONALITY NOW AVAILABLE IN FILE JAPIO.
SEE HELP CHANGE
AND
http://www.stn-international.de/stndatabases/details/ipc_reform.html <<<

FILE JICST-EPLUS
FILE COVERS 1985 TO 25 DEC 2006 (20061225/ED)

THE JICST-EPLUS FILE HAS BEEN RELOADED TO REFLECT THE 1999 CONTROLLED TERM (/CT) THESAURUS RELOAD.

FILE USPATFULL
FILE COVERS 1971 TO PATENT PUBLICATION DATE: 2 Jan 2007 (20070102/PD)
FILE LAST UPDATED: 2 Jan 2007 (20070102/ED)
HIGHEST GRANTED PATENT NUMBER: US7159245
HIGHEST APPLICATION PUBLICATION NUMBER: US2006294631
CA INDEXING IS CURRENT THROUGH 2 Jan 2007 (20070102/UPCA)
ISSUE CLASS FIELDS (/INCL) CURRENT THROUGH: 2 Jan 2007 (20070102/PD)
REVISED CLASS FIELDS (/NCL) LAST RELOADED: Jun 2006
USPTO MANUAL OF CLASSIFICATIONS THESAURUS ISSUE DATE: Jun 2006

FILE WPIDS
FILE LAST UPDATED: 22 DEC 2006 <20061222/UP>
MOST RECENT THOMSON SCIENTIFIC UPDATE: 200682 <200682/DW>
DERWENT WORLD PATENTS INDEX SUBSCRIBER FILE, COVERS 1963 TO DATE

>>> YOU ARE IN THE NEW AND ENHANCED DERWENT WORLD PATENTS INDEX <<<

FOR A COPY OF THE DERWENT WORLD PATENTS INDEX STN USER GUIDE,
PLEASE VISIT:
http://www.stn-international.de/training_center/patents/stn_guide.pdf

FOR DETAILS OF THE PATENTS COVERED IN CURRENT UPDATES, SEE
http://scientific.thomson.com/support/patents/coverage/latestupdates/

PLEASE BE AWARE OF THE NEW IPC REFORM IN 2006, SEE
http://www.stn-international.de/stndatabases/details/ipc_reform.html and
http://scientific.thomson.com/media/scpdf/ipcrdwpi.pdf

>>> FOR DETAILS ON THE NEW AND ENHANCED DERWENT WORLD PATENTS INDEX
PLEASE SEE
http://www.stn-international.de/stndatabases/details/dwpi_r.html <<<

10511929

INVENTOR SEARCH

=> d ibib abs ind l5 1-1

L5 ANSWER 1 OF 1 HCAPLUS COPYRIGHT 2007 ACS on STN
ACCESSION NUMBER: 2003:855724 HCAPLUS
DOCUMENT NUMBER: 139:319663
TITLE: Fluorescence technique for on-line monitoring of state of hydrogen-producing microorganisms
INVENTOR(S): **Seibert, Michael; Makarova, Valeriya ; Tsygankov, Anatoly A.; Rubin, Andrew B.**
PATENT ASSIGNEE(S): Midwest Research Institute, USA
SOURCE: PCT Int. Appl., 28 pp.
CODEN: PIXXD2
DOCUMENT TYPE: Patent
LANGUAGE: English
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
WO 2003088736	A1	20031030	WO 2002-US12576	20020419
W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW				
RW: GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM, AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR, BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG				
AU 2002256298	A1	20031103	AU 2002-256298	20020419
US 2005239044	A1	20051027	US 2004-511929	20041018
PRIORITY APPLN. INFO.:			WO 2002-US12576 A	20020419

AB In situ fluorescence method to monitor state of sulfur-deprived algal culture's ability to produce H2 under sulfur depletion, comprising: (a) providing sulfur-deprived algal culture; (b) illuminating culture; (c) measuring onset of H2 percentage in produced gas phase at multiple times to ascertain point immediately after anaerobiosis to obtain H2 data as function of time; and (d) determining any abrupt change in three in situ fluorescence parameters; (i) increase in Ft (steady-state level of chlorophyll fluorescence in light adapted cells); (ii) decrease in Fm' (maximal saturating light induced fluorescence level in light adapted cells); and (iii) decrease in Δ F/Fm' = (Fm'-Ft)/Fm' calculated photochem. activity of photosystem II (PSII) signaling full reduction of plastoquinone pool between PSII and PSI, which indicates start of anaerobic conditions that induces synthesis of hydrogenase enzyme for subsequent H2 production that signal oxidation of plastoquinone pool asmain factor to regulate H2 under sulfur depletion.

IC ICM A01G007-00
ICS C12M001-00; C12M001-34; C12N001-12; C12P001-00; C12P003-00; C12Q001-02; C12Q001-04
CC 9-5 (Biochemical Methods)
Section cross-reference(s): 10, 11
ST fluorescence technique monitoring hydrogen microorganism
IT Anaerobiosis

Chlamydomonas reinhardtii
Chlorella vulgaris
Electroluminescent devices
Fluorometry
Microorganism
Photosystem II
Scenedesmus obliquus
Signal transduction, biological
(fluorescence technique for online monitoring of state of hydrogen-producing microorganisms)

IT Chlorophylls, biological studies
Plastoquinones
RL: BSU (Biological study, unclassified); BIOL (Biological study)
(fluorescence technique for online monitoring of state of hydrogen-producing microorganisms)

IT 7704-34-9, Sulfur, biological studies
RL: BSU (Biological study, unclassified); BIOL (Biological study)
(depletion; fluorescence technique for online monitoring of state of hydrogen-producing microorganisms)

IT 1333-74-0, Hydrogen, biological studies 9027-05-8, Hydrogenase
RL: BSU (Biological study, unclassified); BIOL (Biological study)
(fluorescence technique for online monitoring of state of hydrogen-producing microorganisms)

REFERENCE COUNT: 4 THERE ARE 4 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

SEARCH IN CAPLUS, USPATFULL, WPIDS

```
=> d que stat l27
L7             1 SEA FILE=REGISTRY ABB=ON  HYDROGEN/CN
L8             1 SEA FILE=REGISTRY ABB=ON  SULFUR/CN
L9             1 SEA FILE=REGISTRY ABB=ON  "CHLORELLA VULGARIS, EXT."/CN
L10            3 SEA FILE=REGISTRY ABB=ON  ("CHLAMYDOMONAS REINHARDI ENDONUCLEAS
                 E A"/CN OR "CHLAMYDOMONAS REINHARDII EXONUCLEASE 1"/CN OR
                 "CHLAMYDOMONAS REINHARDTII METALLOPROTEINASE"/CN)
L11       330888 SEA FILE=HCAPLUS ABB=ON  (L7 OR ?HYDROGEN?)(5A)(?PROD? OR
                 ?PREP? OR ?MANUF?) OR ?ANAEROB?
L12          101 SEA FILE=HCAPLUS ABB=ON  L11 AND (?MICROORG? OR ?ALGAL? OR
                 ?ALGAE?)(W)?CULTURE?
L13            4 SEA FILE=HCAPLUS ABB=ON  L12 AND (?FLUOROMET? OR ?FLUORESC? OR
                 ?ELECTROLUM?)
L14            1 SEA FILE=HCAPLUS ABB=ON  L12 AND (?PHOTO? OR ?SIGNAL?)(W)?TRANS
                 DUC?
L15            1 SEA FILE=HCAPLUS ABB=ON  L12 AND (L8 OR ?SULFUR?)(5A)(?DEPLET?
                 OR ?ABSENC? OR ?REMOV?)
L16            4 SEA FILE=HCAPLUS ABB=ON  L13 OR L14 OR L15
L17           19 SEA FILE=HCAPLUS ABB=ON  L12 AND (L9 OR L10 OR ?CHLAMYDOMONAS?
                 OR ?SCENEDESIMUS? OR ?CHLORELLA?)
L18           19 SEA FILE=HCAPLUS ABB=ON  L16 OR L17
L22           15 SEA FILE=HCAPLUS ABB=ON  L18 AND (PRD<20041018 OR PD<20041018)
L25          223 SEA L22
L26            7 SEA L25 AND ?ACTINIC?
L27           21 DUP REMOV L22 L26 (1 DUPLICATE REMOVED)


=> d ibib abs l27 1-21

L27  ANSWER 1 OF 21  USPATFULL on STN
ACCESSION NUMBER:        2006:195588  USPATFULL
TITLE:                   Photosynthetic hydrogen production
INVENTOR(S):             Hankamer, Ben, Kenmore, AUSTRALIA
                         Kruse, Olaf, Bielefeld, GERMANY, FEDERAL REPUBLIC OF

                              NUMBER         KIND    DATE
                         ---------------- ------ --------
PATENT INFORMATION:      US 2006166343      A1   20060727
APPLICATION INFO.:       US 2004-562512     A1   20040707  (10)
                         WO 2004-AU913           20040707
                                                 20060316  PCT 371 date

                                NUMBER         DATE
                         ------------------ --------
PRIORITY INFORMATION:    AU 2003-2003903453 20030707                <--
DOCUMENT TYPE:           Utility
FILE SEGMENT:            APPLICATION
LEGAL REPRESENTATIVE:    MOORE & VAN ALLEN PLLC, P.O. BOX 13706, Research
                         Triangle Park, NC, 27709, US
NUMBER OF CLAIMS:        29
EXEMPLARY CLAIM:         1
NUMBER OF DRAWINGS:      16 Drawing Page(s)
LINE COUNT:              1673
CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AB       A process for the production of hydrogen, comprising
         the steps of: (i) providing a photosynthetic microorganism having
         electron transfer capability through a photosynthetic "light" reaction
         pathway and through a respiratory electron transfer chain involving an
```

oxidative phosphorylation pathway, and which expresses a hydrogenase, wherein regulation of the oxidative phosphorylation pathway is disrupted with the result that electron flow along the respiratory electron transfer chain toward cytochrome oxidase (complex IV) is reduced; ii) culturing the microorganism under microoxic and illuminated conditions; and (iii) collecting evolved hydrogen.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L27 ANSWER 2 OF 21 HCAPLUS COPYRIGHT 2007 ACS on STN
ACCESSION NUMBER: 2005:409639 HCAPLUS
DOCUMENT NUMBER: 142:433031
TITLE: Multi-stage microbial system for continuous **hydrogen production**
INVENTOR(S): Kosourov, Sergey; Ghirardi, Maria L.; Seibert, Michael
PATENT ASSIGNEE(S): Midwest Research Institute, USA
SOURCE: PCT Int. Appl., 23 pp.
CODEN: PIXXD2
DOCUMENT TYPE: Patent
LANGUAGE: English
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
WO 2005042694	A2	20050512	WO 2003-US30992	20031001
WO 2005042694	A3	20050728		

W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW
RW: GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR, BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG

AU 2003282895	A1	20050519	AU 2003-282895	20031001 <--
PRIORITY APPLN. INFO.:			WO 2003-US30992 A	20031001 <--

AB A method of using sequential chemostat culture vessels to provide continuous H2 production, in which photosynthetic O2 evolution and H2 photoprodn. are separated phys. into two sep. bioreactors includes (a) growing a **microorganism culture** able to continuously generate H2 by photosynthetically producing cells at about the early-to-late log state in a 1st photobioreactor operating as a sulfur chemostat under aerobic and/or conditions; (b) continuously feeding cells from the 1st photobioreactor to a 2nd photobioreactor operating under **anaerobic** conditions and sulfur deprivation conditions resulting from constant uptake of sulfate in the 1st bioreactor and a low rate of culture flow between the 1st and 2nd bioreactors, for induction of **hydrogenase** and H2 **photoprodn.** to allow for continuous cultivation of the microorganism's cells in the 1st photobioreactor and constant H2 production in the 2nd photobioreactor; and (c) collecting the H2 gas from the 2nd photobioreactor. The microorganism can be photosynthetic bacteria, cyanobacteria, and green algae. The green algae is **Chlamydomonas** reinhardtii which is grown under **fluorescence** illumination. Subsequent to **fluorescence** illumination the 1st photobioreactor is supplied with a continuous addition of a TAP-sulfur medium containing an amount of sulfate, at a rate sufficient to provide an **anaerobic**

environment.

L27 ANSWER 3 OF 21 HCAPLUS COPYRIGHT 2007 ACS on STN
ACCESSION NUMBER: 2006:434167 HCAPLUS
DOCUMENT NUMBER: 144:449498
TITLE: Novel bioreactor using selectively permeable porous materials
INVENTOR(S): Gyure, Dale C.
PATENT ASSIGNEE(S): USA
SOURCE: Aust. Pat. Appl., 108 pp.
CODEN: AUXXCM
DOCUMENT TYPE: Patent
LANGUAGE: English
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.		DATE
AU 2004229070	A1	20050602	AU 2004-229070		20041112 <--
PRIORITY APPLN. INFO.:			US 2003-520386P	P	20031113 <--

AB This invention provides bioreactors having a selectively permeable porous material with an open pore structure which is useful for **producing products** including **hydrogen**, biomass, chems. and pharmaceuticals. The porous materials are utilized, for example, as one or more portions of entire walls, covers, floors, filters, windows, or tubes of the bioreactor. The bioreactors comprise porous materials that are aerogels, xerogels, or sol-gel glasses, including silica aerogels. The selectively porous materials are gas-permeable, and optionally photopermeable, transparent, hydrophobic and/or capable of functioning as sterile barriers. This invention also provides methods for culturing cells and organisms employing the bioreactors described herein. The invention also further provides methods for **producing** gaseous **products**, including **hydrogen**, biomass, chems., and pharmaceuticals employing the bioreactors described herein. Detailed descriptions and schematic are included.

L27 ANSWER 4 OF 21 USPATFULL on STN
ACCESSION NUMBER: 2005:16838 USPATFULL
TITLE: Modulation of sulfate permease for photosynthetic **hydrogen production**
INVENTOR(S): Melis, Anastasios, El Cerrito, CA, UNITED STATES
Wintz, Hsu-Ching Chen, El Cerrito, CA, UNITED STATES
PATENT ASSIGNEE(S): The Regents of the University of California (U.S. corporation)

	NUMBER	KIND	DATE
PATENT INFORMATION:	US 2005014239	A1	20050120
APPLICATION INFO.:	US 2004-762769	A1	20040121 (10)

RELATED APPLN. INFO.: Continuation-in-part of Ser. No. US 2003-350298, filed on 22 Jan 2003, PENDING

	NUMBER	DATE	
PRIORITY INFORMATION:	US 2002-354760P	20020204 (60)	<--
	US 2002-377902P	20020502 (60)	<--

DOCUMENT TYPE: Utility
FILE SEGMENT: APPLICATION
LEGAL REPRESENTATIVE: BOZICEVIC, FIELD & FRANCIS LLP, 1900 UNIVERSITY AVE, SUITE 200, EAST PALO ALTO, CA, 94303

NUMBER OF CLAIMS: 31
EXEMPLARY CLAIM: 1
NUMBER OF DRAWINGS: 29 Drawing Page(s)
LINE COUNT: 2856
CAS INDEXING IS AVAILABLE FOR THIS PATENT.

AB Sustained **hydrogen production** is obtained by the culturing of a genetically-modified algae, where the ability of the chloroplasts to intake sulfate is reduced or eliminated compared to wild-type algae. The alga is cultured in a sealed environment in a liquid or solid medium that contains sulfur, and hydrogen is generated continuously. Alternatively, the algae may be cultured in the presence of bacteria that also **produce hydrogen** gas. The **hydrogen produced** can be collected and used as a clean energy source.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L27 ANSWER 5 OF 21 HCAPLUS COPYRIGHT 2007 ACS on STN DUPLICATE 1
ACCESSION NUMBER: 2003:855724 HCAPLUS
DOCUMENT NUMBER: 139:319663
TITLE: **Fluorescence** technique for on-line monitoring of state of **hydrogen-producing** microorganisms
INVENTOR(S): Seibert, Michael; Makarova, Valeriya; Tsygankov, Anatoly A.; Rubin, Andrew B.
PATENT ASSIGNEE(S): Midwest Research Institute, USA
SOURCE: PCT Int. Appl., 28 pp.
CODEN: PIXXD2
DOCUMENT TYPE: Patent
LANGUAGE: English
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
WO 2003088736	A1	20031030	WO 2002-US12576	20020419 <--
W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW				
RW: GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM, AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR, BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG				
AU 2002256298	A1	20031103	AU 2002-256298	20020419 <--
US 2005239044	A1	20051027	US 2004-511929	20041018 <--

PRIORITY APPLN. INFO.: WO 2002-US12576 A 20020419 <--

AB In situ **fluorescence** method to monitor state of sulfur-deprived **algal culture**'s ability to produce H2 under **sulfur depletion**, comprising: (a) providing **sulfur**-deprived **algal culture**; (b) illuminating culture; (c) measuring onset of H2 percentage in produced gas phase at multiple times to ascertain point immediately after **anaerobiosis** to obtain H2 data as function of time; and (d) determining any abrupt change in three in situ **fluorescence** parameters; (i) increase in Ft (steady-state level of chlorophyll **fluorescence** in light adapted cells); (ii) decrease in Fm' (maximal saturating light induced **fluorescence** level in light adapted cells); and (iii) decrease in

Δ F/Fm' = (Fm'-Ft)/Fm' calculated photochem. activity of photosystem II (PSII) signaling full reduction of plastoquinone pool between PSII and PSI, which indicates start of **anaerobic** conditions that induces synthesis of **hydrogenase** enzyme for subsequent H2 **prodn** . that signal oxidation of plastoquinone pool asmain factor to regulate H2 under **sulfur depletion.**

REFERENCE COUNT: 4 THERE ARE 4 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L27 ANSWER 6 OF 21 USPATFULL on STN

ACCESSION NUMBER: 2003:232073 USPATFULL

TITLE: Modulation of sulfate permease for photosynthetic **hydrogen production**

INVENTOR(S): Melis, Anastasios, El Cerrito, CA, UNITED STATES
Wintz, Hsu-Ching Chen, El Cerrito, CA, UNITED STATES

	NUMBER	KIND	DATE	
PATENT INFORMATION:	US 2003162273	A1	20030828	<--
APPLICATION INFO.:	US 2003-350298	A1	20030122	(10)

	NUMBER	DATE	
PRIORITY INFORMATION:	US 2002-354760P	20020204	(60) <--
	US 2002-377902P	20020502	(60) <--

DOCUMENT TYPE: Utility
FILE SEGMENT: APPLICATION
LEGAL REPRESENTATIVE: BOZICEVIC, FIELD & FRANCIS LLP, 200 MIDDLEFIELD RD, SUITE 200, MENLO PARK, CA, 94025
NUMBER OF CLAIMS: 31
EXEMPLARY CLAIM: 1
NUMBER OF DRAWINGS: 20 Drawing Page(s)
LINE COUNT: 2426
CAS INDEXING IS AVAILABLE FOR THIS PATENT.

AB Sustained **hydrogen production** is obtained by the culturing of a genetically-modified algae, where the ability of the chloroplasts to intake sulfate is reduced or eliminated compared to wild-type algae. The alga is cultured in a sealed environment in a liquid or solid medium that contains sulfur, and hydrogen is generated continuously. Alternatively, the algae may be cultured in the presence of bacteria that also **produce hydrogen** gas. The **hydrogen produced** can be collected and used as a clean energy source.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L27 ANSWER 7 OF 21 HCAPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 2003:320928 HCAPLUS

DOCUMENT NUMBER: 139:81833

TITLE: Accumulation of ferrous iron in **Chlamydomonas** reinhardtii. Influence of CO2 and **anaerobic** induction of the reversible hydrogenase

AUTHOR(S): Semin, Boris K.; Davletshina, Lira N.; Novakova, Alla A.; Kiseleva, Tat'yana Y.; Lanchinskaya, Victoriya Y.; Aleksandrov, Anatolii Y.; Seifulina, Nora; Ivanov, Il'ya I.; Seibert, Michael; Rubin, Andrei B.

CORPORATE SOURCE: Biological Faculty, Moscow State University, Moscow, 119899, Russia

SOURCE: Plant Physiology (**2003**), 131(4), 1756-1764
CODEN: PLPHAY; ISSN: 0032-0889

PUBLISHER: American Society of Plant Biologists
DOCUMENT TYPE: Journal
LANGUAGE: English
AB The green alga, **Chlamydomonas** reinhardtii, can photoproduce mol. H2 via ferredoxin and the reversible [Fe] hydrogenase enzyme under **anaerobic** conditions. Recently, a novel approach for sustained H2 gas photoprodn. was discovered in cell cultures subjected to S-deprived conditions (A. Melis, L. Zhang, M. Forestier, M.L. Ghirardi, M. Seibert [2000] Plant Physiol 122: 127-135). The close relationship between S and Fe in the H2-production process is of interest because Fe-S clusters are constituents of both ferredoxin and hydrogenase. In this study, we used Mossbauer spectroscopy to examine both the uptake of Fe by the alga at different CO2 concns. during growth and the influence of **anaerobiosis** on the accumulation of Fe. Algal cells grown in media with 57Fe(III) at elevated (3%, volume/volume) CO2 concentration exhibit elevated levels of Fe and have two comparable pools of the ion: (a) Fe(III) with Mossbauer parameters of quadrupole splitting = 0.65 mm s-1 and isomeric shift = 0.46 mm s-1 and (b) Fe(II) with quadrupole splitting = 3.1 mm s-1 and isomeric shift = 1.36 mm s-1. Disruption of the cells and use of the specific Fe chelator, bathophenanthroline, have demonstrated that the Fe(II) pool is located inside the cell. The amount of Fe(III) in the cells increases with the age of the **algal culture**, whereas the amount of Fe(II) remains constant on a chlorophyll basis. Growing the algae under atmospheric CO2 (limiting) conditions, compared with 3% (volume/volume) CO2, resulted in a decrease in the intracellular Fe(II) content by a factor of 3. Incubating C. reinhardtii cells, grown at atmospheric CO2 for 3 h in the dark under **anaerobic** conditions, not only induced hydrogenase activity but also increased the Fe(II) content in the cells up to the saturation level observed in cells grown aerobically at high CO2. This result is novel and suggests a correlation between the amount of Fe(II) cations stored in the cells, the CO2 concentration, and **anaerobiosis.** A comparison of Fe-uptake results with a cyanobacterium, yeast, and algae suggests that the intracellular Fe(II) pool in C. reinhardtii may reside in the cell vacuole.
REFERENCE COUNT: 37 THERE ARE 37 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L27 ANSWER 8 OF 21 USPATFULL on STN
ACCESSION NUMBER: 2002:268600 USPATFULL
TITLE: Method for treating a waste stream using photosynthetic microorganisms
INVENTOR(S): Wexler, Howard M., 32 Summer Glen, Bristol, CT, United States 06010
Startari, Joseph F., Clearwater, FL, United States
PATENT ASSIGNEE(S): Biotechna Environmental International, Ltd., Anguilla, SAINT KITTS AND NEVIS (non-U.S. corporation)
Wexler, Howard M., Bristol, CT, United States (U.S. individual)

	NUMBER	KIND	DATE	
PATENT INFORMATION:	US 6465240	B1	20021015	<--
APPLICATION INFO.:	US 1998-210153		19981211 (9)	

DOCUMENT TYPE: Utility
FILE SEGMENT: GRANTED
PRIMARY EXAMINER: Naff, David M.
ASSISTANT EXAMINER: Ware, Deborah K.
LEGAL REPRESENTATIVE: Garabedian, Todd E., Wiggin & Dana
NUMBER OF CLAIMS: 18

EXEMPLARY CLAIM: 1
NUMBER OF DRAWINGS: 4 Drawing Figure(s); 3 Drawing Page(s)
LINE COUNT: 834
CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AB A method is provided for treating a waste stream by contacting the waste stream sequentially with a consortium of prokaryotic microorganisms, preferably purple non-sulfur bacteria, followed by a the green algae **Chlorella.** The consortium of prokaryotic microorganisms assimilate a first portion of the wastes, and the green algae assimilate the remaining portion of the wastes to produce a substantially purified effluent stream. Isolated microorganisms made by the above method are valuable commercial products.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L27 ANSWER 9 OF 21 USPATFULL on STN
ACCESSION NUMBER: 2002:168080 USPATFULL
TITLE: Method for treating a waste stream using photosynthetic microorganisms
INVENTOR(S): Wexler, Howard M., 32 Summer Glen, Bristol, CT, United States 06010
Startari, Joseph F., Clearwater, FL, United States
PATENT ASSIGNEE(S): Biotechna Environmental International, Ltd., SAINT KITTS AND NEVIS (non-U.S. corporation)
Wexler, Howard M., Bristol, CT, United States (U.S. individual)

	NUMBER	KIND	DATE	
PATENT INFORMATION:	US 6416993	B1	20020709	<--
APPLICATION INFO.:	US 1999-263040		19990305 (9)	

RELATED APPLN. INFO.: Continuation-in-part of Ser. No. US 1998-210153, filed on 11 Dec 1998
DOCUMENT TYPE: Utility
FILE SEGMENT: GRANTED
PRIMARY EXAMINER: Naff, David M.
ASSISTANT EXAMINER: Ware, Deborah K
LEGAL REPRESENTATIVE: Garabedian, Todd E., Wiggin & Dana
NUMBER OF CLAIMS: 39
EXEMPLARY CLAIM: 1
NUMBER OF DRAWINGS: 6 Drawing Figure(s); 5 Drawing Page(s)
LINE COUNT: 1253
CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AB The present invention is directed to a method for treating a waste stream by contacting the waste stream sequentially with a consortium of prokaryotic microorganisms, preferably purple non-sulfur bacteria, followed by a the green algae **Chlorella.** The consortium of prokaryotic microorganisms assimilate a first portion of the wastes, and the green algae assimilate the remaining portion of the wastes to produce a substantially purified effluent stream. The process of the present invention preferably includes a photobioreactor in order to increase the amount of light made available to the photosynthetic microorganisms, and result in improved uptake of waste materials from the waste stream.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L27 ANSWER 10 OF 21 HCAPLUS COPYRIGHT 2007 ACS on STN
ACCESSION NUMBER: 2002:726134 HCAPLUS
DOCUMENT NUMBER: 138:15159

TITLE: Dilution methods to deprive **Chlamydomonas** reinhardtii cultures of sulfur for subsequent **hydrogen photoproduction**
AUTHOR(S): Laurinavichene, Tatyana V.; Tolstygina, Irena V.; Galiulina, Rumiya R.; Ghirardi, Maria L.; Seibert, Michael; Tsygankov, Anatoly A.
CORPORATE SOURCE: Russian Academy of Sciences, Institute of Basic Biological Problems, Moscow Region, Pushchino, 142290, Russia
SOURCE: International Journal of Hydrogen Energy (**2002**), 27(11-12), 1245-1249
CODEN: IJHEDX; ISSN: 0360-3199
PUBLISHER: Elsevier Science Ltd.
DOCUMENT TYPE: Journal
LANGUAGE: English

AB Sulfur deprivation of **Chlamydomonas** reinhardtii cultures gradually inactivates photosynthetic O2 evolution and leads to the establishment of **anaerobiosis** in the medium. Sulfur-deprived **algal cultures** kept under **anaerobic** conditions will then produce H2 gas for 3-5 days under continuous illumination. Currently, sulfur deprivation is achieved by mech. centrifugation of cultures grown in sulfur-replete medium, followed by extensive and costly washing. The cells are finally resuspended in sulfur-free medium. The current study investigates two procedures to deprive **algal cultures** of sulfur that eliminate the centrifugation step. These procedures involve sulfur deprivation by dilution of sulfur-replete cultures into either sulfur-limited medium or sulfur-free medium. Efficient H2 photoprodn. can be achieved on a timely basis by using either procedure. However, the dilution of sulfate-replete **algal cultures** 1:10 volume/volume into sulfur-free medium is the most appropriate procedure. These observations serve as the basis for developing an algal H2-production system that is cheaper, less time-consuming, and less amenable to contamination with other microorganisms than systems employing centrifugation for sulfur deprivation.

REFERENCE COUNT: 11 THERE ARE 11 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L27 ANSWER 11 OF 21 USPATFULL on STN
ACCESSION NUMBER: 2001:233315 USPATFULL
TITLE: **Hydrogen production** using **hydrogenase**-containing oxygenic photosynthetic organisms
INVENTOR(S): Anastasios, Melis, El Cerrito, CA, United States
Zhang, Liping, Kensington, CA, United States
Benemann, John R., Walnut Creek, CA, United States
Forestier, Marc, Lakewood, CO, United States
Ghirardi, Maria, Lakewood, CO, United States
Seibert, Michael, Lakewood, CO, United States

	NUMBER	KIND	DATE	
PATENT INFORMATION:	US 2001053543	A1	20011220	<--
	US 6989252	B2	20060124	
APPLICATION INFO.:	US 2000-748690	A1	20001222 (9)	

	NUMBER	DATE	
PRIORITY INFORMATION:	US 1999-173391P	19991228 (60)	<--

DOCUMENT TYPE: Utility
FILE SEGMENT: APPLICATION

LEGAL REPRESENTATIVE: PAUL J WHITE, SENIOR COUNSEL, NATIONAL RENEWABLE ENERGY LABORATORY (NREL), 1617 COLE BOULEVARD, GOLDEN, CO, 80401-3393
NUMBER OF CLAIMS: 10
EXEMPLARY CLAIM: 1
NUMBER OF DRAWINGS: 8 Drawing Page(s)
LINE COUNT: 675
CAS INDEXING IS AVAILABLE FOR THIS PATENT.

AB A reversible physiological process provides for the temporal separation of oxygen evolution and **hydrogen production** in a microorganism, which includes the steps of growing a culture of the microorganism in medium under illuminated conditions to accumulate an endogenous substrate, depleting from the medium a nutrient selected from the group consisting of sulfur, iron, and/or manganese, sealing the culture from atmospheric oxygen, incubating the culture in light whereby a rate of light-induced oxygen production is equal to or less than a rate of respiration, and collecting an evolved gas. The process is particularly useful to accomplish a sustained photobiological **hydrogen** gas **production** in cultures of microorganisms, such as **Chlamydomonas** reinhardtii.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L27 ANSWER 12 OF 21 HCAPLUS COPYRIGHT 2007 ACS on STN
ACCESSION NUMBER: 2001:508823 HCAPLUS
DOCUMENT NUMBER: 135:256180
TITLE: Maximizing photosynthetic efficiencies and **hydrogen production** in microalga cultures
AUTHOR(S): Polle, J.; Kanakagiri, S.; Benemann, J. R.; Melis, A.
CORPORATE SOURCE: Department of Plant and Microbial Biology, University of California, Berkeley, CA, 94720-3102, USA
SOURCE: Biohydrogen II: An Approach to Environmentally Acceptable Technology, [Workshop on Biohydrogen], 2nd, Tsukuba, Japan, June, 1999 (**2001**), Meeting Date 1999, 111-130. Editor(s): Miyake, Jun; Matsunaga, Tadashi; San Pietro, Anthony. Elsevier Science Ltd.: Oxford, UK.
CODEN: 69BMBB
DOCUMENT TYPE: Conference
LANGUAGE: English

AB For algal mass cultures and H2 production, conditions that maximize photosynthetic productivity and solar conversion efficiency are important in determining sustainability and profit. We have shown (Melis et al. 1999) that photosynthetic efficiencies and **hydrogen production** by **microalgal cultures** can be increased upon minimizing the number of the light-harvesting chlorophy II (Chl) antenna pigments of photosynthesis. A highly truncated light-harvesting Chl antenna size in green algae could result in: (a) 6-7 times greater photosynthetic productivity (on a per Chl basis), compared to that of normally pigmented cells, and (b) .apprx.3 times greater yields of photosynthesis and H2 production under mass culture, compared to that of normally pigmented cells. We report here the application of mol. genetic approaches for the generation of transformant green algae with a permanently truncated Chl antenna size. Upon generating and screening a library of 6.500 DNA insertional transformants in the green alga **Chlamydomonas** reinhardtii, 155 mutants aberrant in Chl **fluorescence**, i.e., possibly aberrant in Chl antenna size, have been isolated. Three distinct classes of mutants were identified: mutants aberrant in Chl b biosynthesis and mutants aberrant in the regulation of

the Chl antenna size (both down-regulated and up-regulated). Initial biochem. characterization of some of these mutants is presented. The work provides evidence that a smaller and stable Chl antenna size in green algae can be achieved through the application of mol. genetic techniques. Moreover, some unique insights were gained from a detailed examination of the Chl b-less mutant. This mutation was partially overcome through a nearly quant. substitution of Chl b with Chl a in. Photosystem-I (PSI), and by a partial substitution by Chl a in PSII. These substitutions resulted in a PSI Chl antenna size almost as large in the mutant as in the control, but a PSII antenna size in the mutant that was less than half of that in the control. Genetically engineered algae with a "truncated Chl antenna" can increase the productivity of the culture under moderate to high irradiance. Immediate future plans include the biochem. anal. of addnl. isolates in search of the smallest possible Chl antenna size for PSII and PSI, and the cloning and sequencing of the genes that regulate the Chl antenna size of photosynthesis.

REFERENCE COUNT: 52 THERE ARE 52 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L27 ANSWER 13 OF 21 HCAPLUS COPYRIGHT 2007 ACS on STN
ACCESSION NUMBER: 1993:253357 HCAPLUS
DOCUMENT NUMBER: 118:253357
TITLE: Biogas purification process using intensive **microalgae cultures**
AUTHOR(S): Conde, J. L.; Moro, L. E.; Travieso, L.; Sanchez, E. P.; Leiva, A.; Dupeirdn, R.; Escobedo, R.
CORPORATE SOURCE: Natl. Cent. Sci. Res., Environ. Pollut. Dep., Havana, Cuba
SOURCE: Biotechnology Letters (**1993**), 15(3), 317-20
CODEN: BILED3; ISSN: 0141-5492
DOCUMENT TYPE: Journal
LANGUAGE: English
AB The main contaminants (CO2 and H2S) in biogas produced by **anaerobic** digestion can be removed by an intensive mass culture of microalgae.

L27 ANSWER 14 OF 21 HCAPLUS COPYRIGHT 2007 ACS on STN
ACCESSION NUMBER: 1992:406076 HCAPLUS
DOCUMENT NUMBER: 117:6076
TITLE: Immobilized cells of a unicellular green alga and a photosynthetic bacterium for use in a biophotolysis system
AUTHOR(S): Miyamoto, Kazuhisa; Matsuoka, Sinjirou; Miura, Yoshiharu; Negoro, Masaaki
CORPORATE SOURCE: Fac. Pharm. Sci., Osaka Univ., Suita, 565, Japan
SOURCE: Applied Biochemistry and Biotechnology (**1992**), 34-35, 459-66
CODEN: ABIBDL; ISSN: 0273-2289
DOCUMENT TYPE: Journal
LANGUAGE: English
AB Immobilization of algal and bacterial cells was investigated and found applicable for H2 production A unicellular green alga, **Chlamydomonas** reinhardtii, and a photosynthetic bacterium, Rhodospirillum rubrum, were sep. entrapped in Ca alginate gel. Photosynthetic starch accumulation and subsequent dark fermentation by C. reinhardtii were not affected by cell immobilization in Ca alginate gel. Immobilized cells of R. rubrum retained their ability to utilize various electron donors for H2 evolution. Immobilized R. rubrum was stable for ≥1 wk in a light and dark cycle. These and other observations suggest that the immobilization of cells could facilitate the recycling of broth between an

algal culture system and a bacterial H2 production unit.

L27 ANSWER 15 OF 21 HCAPLUS COPYRIGHT 2007 ACS on STN
ACCESSION NUMBER: 1994:676394 HCAPLUS
DOCUMENT NUMBER: 121:276394
TITLE: Zinc fed **algal cultures** (**Chlorella** vulgaris)
AUTHOR(S): Ansari, Zamir Ahmad
CORPORATE SOURCE: Department of Chemistry, University of Engineering and Technology, Lahore, Pak.
SOURCE: Pakistan Journal of Science (**1992**), 44, 61-5
CODEN: PAJSAS; ISSN: 0030-9877
DOCUMENT TYPE: Journal
LANGUAGE: English
AB Algal (C. vulgarus) growth rate and metabolism, e.g. protein **production**, chlorophyll content, and lactate **dehydrogenase** (LD) activity, were studied in response to varying concns. of Zn (from 1 to 12 ppm). Zinc chloride and zinc-EDTA were used as sources. The effects of illumination and pH variation at constant temperature (26°) were also observed Maximum metabolic activities were obtained by batch growth in 7 ppm zinc chloride at pH 5-6 and illumination 5000 lx. Thus, the optimal zinc dosage is 7 ppm; at concns. beyond this toxic effects are observed

L27 ANSWER 16 OF 21 HCAPLUS COPYRIGHT 2007 ACS on STN
ACCESSION NUMBER: 1990:513901 HCAPLUS
DOCUMENT NUMBER: 113:113901
TITLE: Fermentation apparatus for photosynthetic bacteria and algae
INVENTOR(S): Creti, Christian; Valter, Francis; Depeyre, Dominique; Isambert, Arsene; Alexandre, Jean
PATENT ASSIGNEE(S): Ecole Centrale des Arts et Manufactures, Fr.
SOURCE: Fr. Demande, 24 pp.
CODEN: FRXXBL
DOCUMENT TYPE: Patent
LANGUAGE: French
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
FR 2635531	A1	19900223	FR 1988-10985	19880818 <--
FR 2635531	B1	19920717		
CA 2036885	A1	19920823	CA 1991-2036885	19910222 <--
PRIORITY APPLN. INFO.:			FR 1988-10985	19880818 <--

AB A fermentation apparatus for continuous culture of photosynthetic bacteria and algae for use in the removal of H2S from waste gases and in the growth of edible biomass is described. The **microorganism, culture** media and a H2S-containing gas are efficiently mixed by passing them through a nozzle. The resulting mass of bacteria is passed into a settling tank from which it is recovered by decantation. The gas may come from methanogenic decomposition of organic waste or from industrial waste gases. Chromatium was grown using this system under illumination of 1000 lx at 890, 750, and 550 nm using a reactor of 7000 mL passing the culture through the nozzle at 100 L/h whilst mixing it with H2S-containing gas from methanogenic decomposition of organic waste (1% H2S) at 500 L/day. Gases from this fermentation had a S content of <1 ppm. Yield of bacteria was 7 g dry. weight/day.

L27 ANSWER 17 OF 21 HCAPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 1987:436365 HCAPLUS
DOCUMENT NUMBER: 107:36365
TITLE: **Hydrogen production** by a mixed culture of a green alga, **Chlamydomonas** reinhardti and a photosynthetic bacterium, Rhodospirillum rubrum
AUTHOR(S): Miyamoto, Kazuhisa; Ohta, Souichi; Nawa, Yoshihito; Mori, Yasuko; Miura, Yoshiharu
CORPORATE SOURCE: Fac. Pharm. Sci., Osaka Univ., Suita, 565, Japan
SOURCE: Agricultural and Biological Chemistry (**1987**), 51(5), 1319-24
CODEN: ABCHA6; ISSN: 0002-1369
DOCUMENT TYPE: Journal
LANGUAGE: English
AB A .apprx.4-fold H2 evolution rate and a 5-fold H2 molar yield (mol H2/mol glucose) were obtained with a mixed culture of C. reinhardti and R. rubrum compared with an **algal culture** of C. reinhardti alone. This increasing effect was due to the consumption of formate formed by C. reinhardti; R. rubrum evolved H2 from formate via the formate hydrogen-lyase system under dark **anaerobic** (N2) conditions. Maximum H2 evolution by the mixed culture was observed with a ratio of 8:2 (alga:bacterium) at a total cell concentration >0.6 mg dry weight/mL. Sustained H2 production with an alternating light/dark cycle in a membrane reactor, in which this alga and bacterium were cultured in sep. compartments, was performed for 1 wk.

L27 ANSWER 18 OF 21 HCAPLUS COPYRIGHT 2007 ACS on STN
ACCESSION NUMBER: 1984:38999 HCAPLUS
DOCUMENT NUMBER: 100:38999
TITLE: Intensive culture of **Chlorella** vulgaris/AA as the second stage of biological purification of nitrogen industry wastewaters
AUTHOR(S): Przytocka-Jusiak, Magdalena; Duszota, Marek; Matusiak, Kazimierz; Mycielski, Roman
CORPORATE SOURCE: Inst. Microbiol., Warsaw Univ., Warsaw, 00-324, Pol.
SOURCE: Water Research (**1984**), 18(1), 1-7
CODEN: WATRAG; ISSN: 0043-1354
DOCUMENT TYPE: Journal
LANGUAGE: English
AB A method for the 2-stage removal of N from highly loaded nitrogeneous wastewaters carrying varying proportions of NO3-, NO2-, and NH4+ is presented. The method combines bacterial denitrification and nitrification by an intensive **algal culture.** Denitrification in an **anaerobic** packed bed reactor removed all the oxidized forms of N from the wastes enriched in MeOH and P. NH4+ remaining in the denitrified wastewaters was removed by intensive culture of algae. The use of this method resulted in 94.0-99.9% removal of N from the wastes. The application of the proposed method is limited, however, by the concentration of NH4+ wastewaters.

L27 ANSWER 19 OF 21 HCAPLUS COPYRIGHT 2007 ACS on STN
ACCESSION NUMBER: 1974:435493 HCAPLUS
DOCUMENT NUMBER: 81:35493
TITLE: Photoheterotrophic metabolism in algae. II. Heterotrophic culture of algae in a closed system
AUTHOR(S): Nakayama, Ooki; Ueno, Tadashi; Tsuchiya, Fusae
CORPORATE SOURCE: Fac. Eng., Yamanashi, Univ., Kofu, Japan
SOURCE: Hakko Kogaku Zasshi (**1974**), 52(4), 225-32
CODEN: HKZAA2; ISSN: 0367-5963

DOCUMENT TYPE: Journal
LANGUAGE: English
AB Among 217 strains of unicellular algae, only 2 strains of **Chlorella** were able to grow under **anaerobic** conditions. When O2 and CO2-absorbers were not used, many strains grew in the closed system with an organic medium and N atmospheric under light. C. pyrenoidosa strain C-28 yielded 71.8, 66.8, and 47.9 mg of biomass from 100 mg of glucose in a closed culture under light, an open culture under light, and an open culture without light, resp. The benefits of **algal culture** in a closed system for sewage purification combined with food production was discussed.

L27 ANSWER 20 OF 21 HCAPLUS COPYRIGHT 2007 ACS on STN
ACCESSION NUMBER: 1970:517601 HCAPLUS
DOCUMENT NUMBER: 73:117601
TITLE: **Anaerobic** decomposition of algae
AUTHOR(S): Foree, Edward G.; McCarty, Perry L.
CORPORATE SOURCE: Dep. of Civil Eng., Stanford Univ., Stanford, CA, USA
SOURCE: Environmental Science and Technology (**1970**), 4(10), 842-9
CODEN: ESTHAG; ISSN: 0013-936X
DOCUMENT TYPE: Journal
LANGUAGE: English
AB The major objective was to determine the rate and extent of algal degradation under simulated natural conditions. Decomposition of heterogeneous and **unialgal cultures** was studied under dark, **anaerobic**, constant-temperature laboratory conditions. Effects of high sulfate concentration, bacterial seedings, temperature, pH, and cell composition on the rate and extent of degradation were evaluated. After 200 days, decomposition of **algal cultures** was essentially complete, and the undecomposed particulate organic matter remaining was termed the refractory organic fraction. This fraction ranged from 20-60% of the ash-free dry weight for various cultures with an average of 40%. The decomposition of the biodegradable organic fraction could be adequately described by first-order decay kinetics with a range for the decay constant k of 0.011-0.032/day with an average 0.022/day. The rate and extent of degradation were similar to those found by other investigators under aerobic decomposition conditions.

L27 ANSWER 21 OF 21 HCAPLUS COPYRIGHT 2007 ACS on STN
ACCESSION NUMBER: 1967:430068 HCAPLUS
DOCUMENT NUMBER: 67:30068
TITLE: A methane-consuming green alga
AUTHOR(S): Enebo, Lennart
CORPORATE SOURCE: Roy. Inst. Technol., Stockholm, Swed.
SOURCE: Acta Chemica Scandinavica (1947-1973) (**1967**), 21(3), 625-32
CODEN: ACSAA4; ISSN: 0001-5393
DOCUMENT TYPE: Journal
LANGUAGE: English
AB From enrichment cultures of photosynthetic S bacteria, a **Chlorella** was obtained which combined capacities for normal photosynthesis in a medium containing CO32- and for the utilization of methane as C source for growth. The alga was adapted to **anaerobic** conditions, but the photosynthetic O production enabled the alga to affect the environment in this respect. The alga could be almost completely freed from contaminating bacteria (1 bacterium per 104 algae) by repeated subculturing on solid medium of the following composition: Na2CO3, 0.1; (NH4)2SO4, 1.0; K2HPO4, 0.5; MgSO4.7H2O, 0.4; NaCl, 5.0; Na thioglycolate

0.085; Na2S, 0.18; and glucose 10 g./l. of tap water, pH 7.0. The nearly pure **algal culture** thus obtained was cultured under illumination in a medium containing: (NH4)2SO4, 1.0; K2HPO4 0.5; MgSO4.7H2O, 0.4; FeCl3.H2O, 0.0004; CaCl2, 0.006; H3BO3, 0.0034; MnCl2.6H2O, 0.0004; ZnSO4.7H2O, 0.000007; CuSO4.5H2O, 0.0000005; (NH4)6Mo7O24.4H2O, 0.0022; Co(NO3)2.6H2O, 0.0000015 g./l. of distilled water. NaHCO3 was periodically added to maintain a concentration of 45-70 mg./l.; the CO32- was consumed during growth. The amount of growth of the alga was increased by 35-45% if the gas phase was CH4. The implications of the occurrence of methane-consuming photosynthetic organisms for nonterrestrial life was discussed.

SEARCH IN MEDLINE, BIOSIS, EMBASE, JAPIO, JICST

```
=> d que stat l24
L7             1 SEA FILE=REGISTRY ABB=ON  HYDROGEN/CN
L8             1 SEA FILE=REGISTRY ABB=ON  SULFUR/CN
L9             1 SEA FILE=REGISTRY ABB=ON  "CHLORELLA VULGARIS, EXT."/CN
L10            3 SEA FILE=REGISTRY ABB=ON  ("CHLAMYDOMONAS REINHARDI ENDONUCLEAS
                 E A"/CN OR "CHLAMYDOMONAS REINHARDII EXONUCLEASE 1"/CN OR
                 "CHLAMYDOMONAS REINHARDTII METALLOPROTEINASE"/CN)
L11       330888 SEA FILE=HCAPLUS ABB=ON  (L7 OR ?HYDROGEN?)(5A)(?PROD? OR
                 ?PREP? OR ?MANUF?) OR ?ANAEROB?
L12          101 SEA FILE=HCAPLUS ABB=ON  L11 AND (?MICROORG? OR ?ALGAL? OR
                 ?ALGAE?)(W)?CULTURE?
L13            4 SEA FILE=HCAPLUS ABB=ON  L12 AND (?FLUOROMET? OR ?FLUORESC? OR
                 ?ELECTROLUM?)
L14            1 SEA FILE=HCAPLUS ABB=ON  L12 AND (?PHOTO? OR ?SIGNAL?)(W)?TRANS
                 DUC?
L15            1 SEA FILE=HCAPLUS ABB=ON  L12 AND (L8 OR ?SULFUR?)(5A)(?DEPLET?
                 OR ?ABSENC? OR ?REMOV?)
L16            4 SEA FILE=HCAPLUS ABB=ON  L13 OR L14 OR L15
L17           19 SEA FILE=HCAPLUS ABB=ON  L12 AND (L9 OR L10 OR ?CHLAMYDOMONAS?
                 OR ?SCENEDESIMUS? OR ?CHLORELLA?)
L18           19 SEA FILE=HCAPLUS ABB=ON  L16 OR L17
L23           25 SEA L18
L24           18 DUP REMOV L23 (7 DUPLICATES REMOVED)


=> d ibib abs l24 1-18

L24  ANSWER 1 OF 18  BIOSIS  COPYRIGHT (c) 2007 The Thomson Corporation  on STN
ACCESSION NUMBER:    2006:492724  BIOSIS
DOCUMENT NUMBER:     PREV200600482082
TITLE:               Microbial conditions and antimicrobial activity in cultures
                     of two microalgae species, Tetraselmis chuii and
                     Chlorella minutissima, and effect on bacterial load
                     of enriched Artemia metanauplii.
AUTHOR(S):           Makridis, Pavlos [Reprint Author]; Costa, Rita Alves;
                     Dinis, Maria Teresa
CORPORATE SOURCE:    Hellen Ctr Marine Res, POB 2214, GR-71003 Iraklion, Greece
                     makridis@her.hcmr.gr
SOURCE:              Aquaculture, (MAY 31 2006) Vol. 255, No. 1-4, pp. 76-81.
                     CODEN: AQCLAL. ISSN: 0044-8486.
DOCUMENT TYPE:       Article
LANGUAGE:            English
ENTRY DATE:          Entered STN: 27 Sep 2006
                     Last Updated on STN: 27 Sep 2006
AB   The microbial conditions and antimicrobial activity were determined in
     batch cultures of two microalgae species, Tetraselmis chute and
     Chlorella minutissima.  The number of bacteria associated with the
     microalgae cultures showed an exponential growth 2, 10,
     and 16 days after inoculation, and they were higher in T. chuii in all
     three sampling points compared with C. minutissima.  No presumptive Vibrio
     strains were observed in any of the samples, as measured by the growth on
     TCBS agar.  A total of 17 and 30 bacterial strains were isolated from C.
     minutissima and T. chuii, respectively.  A high percentage of
     Gram-positive strains was detected among the bacterial strains isolated,
     as Gram-positive strains constituted 82% (14/17) and 73% (22/30) of the
     total numbers of isolates in C. minutissima and T. chute, respectively.
     The isolated bacteria were screened in vitro for inhibition against two
     pathogenic strains, and nine of the 34 strains tested (26%) showed
```

inhibition in vitro against either Photobacterium damselae, susp. piscicida or Vibrio anguillarum. Incubation of enriched Artemia in cultures of the two microalgae for 30 min resulted in a significant decrease of the bacterial load in Artemia ($P < 0.05$), and a significant decrease of the level of presumptive Vibrio in Artemia homogenates ($P < 0.05$). The results of this study demonstrate a simple and practical approach to decrease the microbial load and at the same time reduce the percentage of Vibrio among the bacteria associated with enriched Artemia.

L24 ANSWER 2 OF 18 MEDLINE on STN DUPLICATE 1
ACCESSION NUMBER: 2005273924 MEDLINE
DOCUMENT NUMBER: PubMed ID: 15917617
TITLE: Continuous **hydrogen photoproduction** by **Chlamydomonas** reinhardtii: using a novel two-stage, sulfate-limited chemostat system.
AUTHOR: Fedorov Alexander S; Kosourov Sergey; Ghirardi Maria L; Seibert Michael
CORPORATE SOURCE: National Renewable Energy Laboratory, Basic Science Center, 1617 Cole Boulevard, Golden, CO 80401, USA.
SOURCE: Applied biochemistry and biotechnology, (2005 Spring) Vol. 121-124, pp. 403-12.
Journal code: 8208561. ISSN: 0273-2289.
PUB. COUNTRY: United States
DOCUMENT TYPE: (EVALUATION STUDIES)
Journal; Article; (JOURNAL ARTICLE)
LANGUAGE: English
FILE SEGMENT: Priority Journals
ENTRY MONTH: 200506
ENTRY DATE: Entered STN: 27 May 2005
Last Updated on STN: 29 Jun 2005
Entered Medline: 28 Jun 2005

AB This study demonstrates, for the first time, that it is possible to couple sulfate-limited **Chlamydomonas** reinhardtii growth to continuous H2 photoproduction for more than 4000 h. A two-stage chemostat system physically separates photosynthetic growth from H2 production, and it incorporates two automated photobioreactors (PhBRs). In the first PhBR, the **algal cultures** are grown aerobically in chemostat mode under limited sulfate to obtain photosynthetically competent cells. Active cells are then continuously delivered to the second PhBR, where H2 production occurs under **anaerobic** conditions. The dependence of the H2 production rate on sulfate concentration in the medium, dilution rates in the PhBRs, and incident light intensity is reported.

L24 ANSWER 3 OF 18 MEDLINE on STN DUPLICATE 2
ACCESSION NUMBER: 2005498424 MEDLINE
DOCUMENT NUMBER: PubMed ID: 16170632
TITLE: The effect of sulfur re-addition on H(2) photoproduction by sulfur-deprived green algae.
AUTHOR: Kosourov Sergey; Makarova Valeriya; Fedorov Alexander S; Tsygankov Anatoly; Seibert Michael; Ghirardi Maria L
CORPORATE SOURCE: National Renewable Energy Laboratory, 1617 Cole Blvd., Golden, CO 80401, USA.
SOURCE: Photosynthesis research, (2005 Sep) Vol. 85, No. 3, pp. 295-305.
Journal code: 100954728. ISSN: 0166-8595.
PUB. COUNTRY: Netherlands
DOCUMENT TYPE: Journal; Article; (JOURNAL ARTICLE)
LANGUAGE: English
FILE SEGMENT: Priority Journals

ENTRY MONTH: 200606
ENTRY DATE: Entered STN: 20 Sep 2005
Last Updated on STN: 1 Jul 2006
Entered Medline: 30 Jun 2006

AB Sulfur deprivation of **algal cultures** selectively and partially inactivates photosystem II (PSII)-catalyzed O(2) evolution, induces **anaerobiosis** and hydrogenase expression, and results in sustained H(2) photoproduction for several days. We show that re-addition of limiting amounts of sulfate (1-10 microM final concentration) to the cultures during the H(2)-production phase temporarily reactivates PSII photochemical and O(2)-evolution activity and re-establishes higher rates of electron transport through the photosynthetic electron transport chain. The reactivation of PSII occurs by de novo D1 protein synthesis, but does not result in the re-establishment of aerobic conditions in the reactor, detectable by dissolved-O(2) sensors. However, concomitant H(2) photoproduction is inhibited, possibly due to excessive intra-cellular levels of photosynthetically-evolved O(2). The partial recovery of electron transport rates correlates with the re-oxidation of the plastoquinone (PQ) pool, as observed by pulse-amplitude modulated (PAM) and **fluorescence**-induction measurements. These results show that the presence of a more oxidized PQ pool releases some of the down-regulation of electron transport caused by the **anaerobic** conditions.

L24 ANSWER 4 OF 18 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN
ACCESSION NUMBER: 2006:87623 BIOSIS
DOCUMENT NUMBER: PREV200600090974
TITLE: Growth promoting and inhibiting effects of extracellular substances of soil microalgae and cyanobacteria on Escherichia coli and Micrococcus luteus.
AUTHOR(S): Safonova, Elena; Reisser, Werner [Reprint Author]
CORPORATE SOURCE: Univ Leipzig, Inst Biol 1, Dept Gen and Appl Bot, Johannisallee 21-23, D-04103 Leipzig, Germany
reisser@rz.uni-leipzig.de
SOURCE: Phycological Research, (SEP 2005) Vol. 53, No. 3, pp. 189-193.
ISSN: 1322-0829.
DOCUMENT TYPE: Article
LANGUAGE: English
ENTRY DATE: Entered STN: 25 Jan 2006
Last Updated on STN: 25 Jan 2006

AB Different taxa of chlorophycean, trebouxiophycean and xanthophycean soil microalgae and of cyanobacteria have been tested for the release of substances that inhibit the growth of either Echerichia coli (Migula) Castellani et Chalmersor Micrococcus luteus (Schroeter) Cohn. Experiments suggest two types of antibacterial effects: one type is constitutive; that is, the antibacterial activity is always present in the **algal culture** medium, as is the case with the Chroococcus turgidus (medium that inhibits the growth of Escherichia coli). The other type is induced; that is, the antibacterial activity occurs only when algae are in contact with bacteria. This is the case when growth of Micrococcus luteus is inhibited in co-culture with Chroococcus turgidus (Kutzing) Nageli or with Xanthonema debile (Vischer) Silva and when growth of Escherichia coli is inhibited in co-culture with Tetracystis sp. As well as inhibition, promotion of bacterial growth was observed. This was probably an unspecific effect resulting from soluble organic and inorganic substances, such as carbohydrates, that are generally present in **algal cultures.**

L24 ANSWER 5 OF 18 MEDLINE on STN DUPLICATE 3

ACCESSION NUMBER: 2003174270 MEDLINE
DOCUMENT NUMBER: PubMed ID: 12692334
TITLE: Accumulation of ferrous iron in **Chlamydomonas** reinhardtii. Influence of CO2 and **anaerobic** induction of the reversible hydrogenase.
AUTHOR: Semin Boris K; Davletshina Lira N; Novakova Alla A; Kiseleva Tat'yana Y; Lanchinskaya Victoriya Y; Aleksandrov Anatolii Y; Seifulina Nora; Ivanov Il'ya I; Seibert Michael; Rubin Andrei B
CORPORATE SOURCE: Biological Faculty, Moscow State University, Russia.
SOURCE: Plant physiology, (2003 Apr) Vol. 131, No. 4, pp. 1756-64. Journal code: 0401224. ISSN: 0032-0889.
PUB. COUNTRY: United States
DOCUMENT TYPE: Journal; Article; (JOURNAL ARTICLE)
LANGUAGE: English
FILE SEGMENT: Priority Journals
ENTRY MONTH: 200308
ENTRY DATE: Entered STN: 16 Apr 2003
Last Updated on STN: 8 Aug 2003
Entered Medline: 7 Aug 2003

AB The green alga, **Chlamydomonas** reinhardtii, can photoproduce molecular H(2) via ferredoxin and the reversible [Fe]hydrogenase enzyme under **anaerobic** conditions. Recently, a novel approach for sustained H(2) gas photoproduction was discovered in cell cultures subjected to S-deprived conditions (A. Melis, L. Zhang, M. Forestier, M.L. Ghirardi, M. Seibert [2000] Plant Physiol 122: 127-135). The close relationship between S and Fe in the H(2)-production process is of interest because Fe-S clusters are constituents of both ferredoxin and hydrogenase. In this study, we used Mossbauer spectroscopy to examine both the uptake of Fe by the alga at different CO(2) concentrations during growth and the influence of **anaerobiosis** on the accumulation of Fe. Algal cells grown in media with (57)Fe(III) at elevated (3%, v/v) CO(2) concentration exhibit elevated levels of Fe and have two comparable pools of the ion: (a) Fe(III) with Mossbauer parameters of quadrupole splitting = 0.65 mm s(-1) and isomeric shift = 0.46 mm s(-1) and (b) Fe(II) with quadrupole splitting = 3.1 mm s(-1) and isomeric shift = 1.36 mm s(-1). Disruption of the cells and use of the specific Fe chelator, bathophenanthroline, have demonstrated that the Fe(II) pool is located inside the cell. The amount of Fe(III) in the cells increases with the age of the **algal culture**, whereas the amount of Fe(II) remains constant on a chlorophyll basis. Growing the algae under atmospheric CO(2) (limiting) conditions, compared with 3% (v/v) CO(2), resulted in a decrease in the intracellular Fe(II) content by a factor of 3. Incubating C. reinhardtii cells, grown at atmospheric CO(2) for 3 h in the dark under **anaerobic** conditions, not only induced hydrogenase activity but also increased the Fe(II) content in the cells up to the saturation level observed in cells grown aerobically at high CO(2). This result is novel and suggests a correlation between the amount of Fe(II) cations stored in the cells, the CO(2) concentration, and **anaerobiosis.** A comparison of Fe-uptake results with a cyanobacterium, yeast, and algae suggests that the intracellular Fe(II) pool in C. reinhardtii may reside in the cell vacuole.

L24 ANSWER 6 OF 18 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN
ACCESSION NUMBER: 2002:379060 BIOSIS
DOCUMENT NUMBER: PREV200200379060
TITLE: Sustained **hydrogen photoproduction** by **Chlamydomonas** reinhardtii: Effects of culture parameters.
AUTHOR(S): Kosourov, Sergey; Tsygankov, Anatoly; Seibert, Michael;

Ghirardi, Maria L. [Reprint author]
CORPORATE SOURCE: Basic Sciences Center, National Renewable Energy Laboratory, Golden, CO, 80401, USA
maria_ghirardi@nrel.gov
SOURCE: Biotechnology and Bioengineering, (June 30, 2002) Vol. 78, No. 7, pp. 731-740. print.
CODEN: BIBIAU. ISSN: 0006-3592.
DOCUMENT TYPE: Article
LANGUAGE: English
ENTRY DATE: Entered STN: 10 Jul 2002
Last Updated on STN: 10 Jul 2002

AB The green alga, **Chlamydomonas** reinhardtii, is capable of sustained H2 photoproduction when grown under sulfur-deprived conditions. This phenomenon is a result of the partial deactivation of photosynthetic O2-evolution activity in response to sulfur deprivation. At these reduced rates of water-oxidation, oxidative respiration under continuous illumination can establish an **anaerobic** environment in the culture. After 10-15 hours of **anaerobiosis**, sulfur-deprived algal cells induce a reversible hydrogenase and start to evolve H2 gas in the light. Using a computer-monitored photobioreactor system, we investigated the behavior of sulfur-deprived algae and found that: (1) the cultures transition through five consecutive phases: an aerobic phase, an O2-consumption phase, an **anaerobic** phase, a H2-production phase and a termination phase; (2) synchronization of cell division during pre-growth with 14:10 h light:dark cycles leads to earlier establishment of **anaerobiosis** in the cultures and to earlier onset of the H2-production phase; (3) re-addition of small quantities of sulfate (12.5-50 muM MgSO4, final concentration) to either synchronized or unsynchronized cell suspensions results in an initial increase in culture density, a higher initial specific rate of H2 production, an increase in the length of the H2-production phase, and an increase in the total amount of H2 produced; and (4) increases in the culture optical density in the presence of 50 muM sulfate result in a decrease in the initial specific rates of H2 production and in an earlier start of the H2-production phase with unsynchronized cells. We suggest that the effects of sulfur re-addition on H2 production, up to an optimal concentration, are due to an increase in the residual water-oxidation activity of the algal cells. We also demonstrate that, in principle, cells synchronized by growth under light:dark cycles can be used in an outdoor H2-production system without loss of efficiency compared to cultures that up until now have been pre-grown under continuous light conditions.

L24 ANSWER 7 OF 18 MEDLINE on STN
ACCESSION NUMBER: 2002308490 MEDLINE
DOCUMENT NUMBER: PubMed ID: 12049920
TITLE: Hydrogenases in green algae: do they save the algae's life and solve our energy problems?.
AUTHOR: Happe Thomas; Hemschemeier Anja; Winkler Martin; Kaminski Annette
CORPORATE SOURCE: Botanisches Institut, Abt. Molekulare Biochemie, Universitat Bonn, Karlrobert-Kreiten-Strasse 13, 53115 Bonn, Germany.. t.happe@uni-bonn.de
SOURCE: Trends in plant science, (2002 Jun) Vol. 7, No. 6, pp. 246-50.
Journal code: 9890299. ISSN: 1360-1385.
PUB. COUNTRY: England: United Kingdom
DOCUMENT TYPE: Journal; Article; (JOURNAL ARTICLE)
LANGUAGE: English
FILE SEGMENT: Priority Journals
ENTRY MONTH: 200207

ENTRY DATE: Entered STN: 11 Jun 2002
Last Updated on STN: 31 Jul 2002
Entered Medline: 30 Jul 2002

AB Green algae are the only known eukaryotes with both oxygenic photosynthesis and a hydrogen metabolism. Recent physiological and genetic discoveries indicate a close connection between these metabolic pathways. The **anaerobically** inducible hydA genes of algae encode a special type of highly active [Fe]-hydrogenase. Electrons from reducing equivalents generated during fermentation enter the photosynthetic electron transport chain via the plastoquinone pool. They are transferred to the hydrogenase by photosystem I and ferredoxin. Thus, the [Fe]-hydrogenase is an electron 'valve' that enables the algae to survive under **anaerobic** conditions. During sulfur deprivation, illuminated **algal cultures** evolve large quantities of hydrogen gas, and this promises to be an alternative future energy source.

L24 ANSWER 8 OF 18 JAPIO (C) 2007 JPO on STN
ACCESSION NUMBER: 1999-196885 JAPIO
TITLE: MARINE MICRO-ALGA PRODUCING ETHANOL
INVENTOR: HIRANO ATSUSHI; HIRAYAMA SHIN; UEDA RYOHEI; KAGAWA SEIJI
PATENT ASSIGNEE(S): TOKYO ELECTRIC POWER CO INC:THE
MITSUBISHI HEAVY IND LTD
PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 11196885	A	19990727	Heisei	C12P007-06

APPLICATION INFORMATION
STN FORMAT: JP 1998-17698 19980114
ORIGINAL: JP10017698 Heisei
PRIORITY APPLN. INFO.: JP 1998-17698 19980114
SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 1999

AN 1999-196885 JAPIO
AB PROBLEM TO BE SOLVED: To obtain a marine micro-alga that can produce ethanol and to provide a process that can efficiently produce ethanol by using the micro-alga in no need of a large amount of water and even in a dry region having reduced amount of rain fall.
SOLUTION: This is a micro-alga in **Chlamydomonas** that grows in an aqueous solution containing salts of sea water concentrations to accumulate starch in its cells and produce ethanol from the starch in the cells by keeping the cells in a dark and **anaerobic** atmosphere.
The ethanol is by culturing a micro- alga, **Chlamydomonas** sp. MT-JE-SH-1 in an aqueous solution containing the salts of the seawater concentrations to accumulate starch in the cells of the micro-algae. Then, the slurry including the cell bodies of the micro-**algae cultured** is held in the dark place and **anaerobic** atmosphere, while the pH of the culture mixture is kept at 6.0-9.0, thereby forming ethanol.

L24 ANSWER 9 OF 18 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN
ACCESSION NUMBER: 1997:118029 BIOSIS
DOCUMENT NUMBER: PREV199799417232
TITLE: Growth inhibition of various organisms by a violet pigment, nostocine A, produced by Nostoc spongiaeforme.
AUTHOR(S): Hirata, Kazumasa [Reprint author]; Takashina, Jun [Reprint author]; Nakagami, Hirofumi [Reprint author]; Ueyama, Sumie

[Reprint author]; Murakami, Kimihiro; Kanamori, Toshinori; Miyamoto, Kazuhisa [Reprint author]
CORPORATE SOURCE: Environmental Bioengineering Lab., Faculty Pharmaceutical Sciences, Osaka Univ., 1-6 Yamadaoka, Suita, Osaka 565, Japan
SOURCE: Bioscience Biotechnology and Biochemistry, (1996) Vol. 60, No. 11, pp. 1905-1906.
ISSN: 0916-8451.
DOCUMENT TYPE: Article
LANGUAGE: English
ENTRY DATE: Entered STN: 10 Mar 1997
Last Updated on STN: 2 Apr 1997
AB A freshwater filamentous cyanobacterium, Nostoc spongiaeforme TISTR 8169, produced and excreted a violet pigment, named nostocine A, in the culture medium. Nostocine A inhibited the growth of some typical strains of microorganisms, **algae**, **cultured** plants, and established animal cell lines.

L24 ANSWER 10 OF 18 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN
ACCESSION NUMBER: 1996:545411 BIOSIS
DOCUMENT NUMBER: PREV199699267767
TITLE: Intensive **microalgae cultures** integrated in an experimental lagooning recycling swine manure.
AUTHOR(S): Sevrin-Reyssac, Josette [Reprint author]; Blier, Remy; Dumas, Andre; Ouelette, Yannick
CORPORATE SOURCE: Lab. Icthyol. Gen. et Appliquee, Museum natl. Histoire Naturelle, 43 rue Cuvier, 75231 Paris Cedex 05, France
SOURCE: Annee Biologique, (1996) Vol. 35, No. 1, pp. 41-68.
CODEN: ANBLAT. ISSN: 0003-5017.
DOCUMENT TYPE: Article
LANGUAGE: French
ENTRY DATE: Entered STN: 13 Dec 1996
Last Updated on STN: 13 Dec 1996

L24 ANSWER 11 OF 18 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN
ACCESSION NUMBER: 1995:230923 BIOSIS
DOCUMENT NUMBER: PREV199598245223
TITLE: Dissertationes Botanicae, Volume 231. Differential gene expression in the green alga **Chlamydomonas** reinhardtii.
AUTHOR(S): Hahn, Daniela
CORPORATE SOURCE: Lehrstuhl Allg. Bot., Ruhr-Univ. Bochum, D-44780 Bochum, Germany
SOURCE: Hahn, D. Dissertationes Botanicae, (1994) pp. x+102p. [Dissertationes Botanicae; Differential gene expression in the green alga Chlamydomonas reinhardtii]. Dissertationes Botanicae; Differentielle Genexpression bei der Gruenalge Chlamydomonas reinhardtii.
Publisher: J. Cramer in der Gebrueder Borntraeger Verlagsbuchhandlung, Berlin, Germany; E. Schweizerbart'sche Verlagsbuchhandlung, Johannesstrasse 3A, D-7000 Stuttgart, Germany. Series: Dissertationes Botanicae.
ISSN: 0070-6728. ISBN: 3-443-64144-X.
DOCUMENT TYPE: Book
LANGUAGE: German
ENTRY DATE: Entered STN: 9 Jun 1995
Last Updated on STN: 9 Jun 1995

AB This monograph on differential expression of nuclear genes in **Chlamydomonas** reinhardtii is intended for plant geneticists. The study involves hybridization of aerobically and **anaerobically** adapted **algal cultures** as well as wild type and photosystem I (PSI)-defective strains. The results of complementary DNA sequence analyses, transcript analyses, and an analysis of the expression of a chimeric LhcbI/reporter gene in PSI-defective strains are discussed. It is concluded that both exogenous and endogenous factors affect the expression of nuclear genes in C. reinhardtii. The characterization of PSI-defective strains helps clarify the complex mechanisms of differential gene expression and reveals that posttranscriptional controls play a decisive role in the expression of nuclear genes. This scientific paper includes molecular sequence data. Northern and Southern blots, RNA analyses, and an extensive bibliography.

L24 ANSWER 12 OF 18 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN

ACCESSION NUMBER: 1993:33242 BIOSIS
DOCUMENT NUMBER: PREV199395021442
TITLE: Biosensors for monitoring pollutions of aquatic systems: Applications of algal electrodes.
AUTHOR(S): Pandard, Pascal; Vasseur, Paule
CORPORATE SOURCE: Lab. Toxicologie, Centre Sciences de l'Environnement, 1 rue des Recollets, BP 4025, 57040 Metz Cedex 1, France
SOURCE: Revue des Sciences de l'Eau, (1992) Vol. 5, No. 3, pp. 445-461.
CODEN: RSEAEX. ISSN: 0992-7158.
DOCUMENT TYPE: Article
LANGUAGE: French
ENTRY DATE: Entered STN: 23 Dec 1992
Last Updated on STN: 24 Dec 1992

AB Several species of unicellular algae were used for these experiments: **Chlorella** vulgaris, Scenedesmus subspicatus and Selenastrum capricornutum. **Algal cultures** were harvested in the exponential growth phase. The sensitivity of this oxygen electrode based biosensor was tested on herbicides (isoproturon, propanil and atrazine), cyanide and heavy metals (copper and mercury). Results were compared with those obtained with three toxicity tests : a standard algal growth inhibition test, the inhibition of photosynthetic activity in spinach leaves and the alga **Chlamydomonas** reinhardii, and the Microtox test using the luminescent bacterium Photobacterium phosphoreum. The oxygen sensor was also very sensitive to cyanide but the response of the probe was quite different if Selenastrum capricornutum or **Chlorella** vulgaris was used. The sensor allowed metal detection but this detection of toxicity was slow compared to that of herbicides or cyanide. Inhibition growth tests and Microtox test were more sensitive than the algal sensor for copper and mercury.

L24 ANSWER 13 OF 18 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN

ACCESSION NUMBER: 1992:9367 BIOSIS
DOCUMENT NUMBER: PREV199293009367; BA93:9367
TITLE: STREPTOMYCIN-RESISTANT EPIPHYTIC BACTERIA WITH HOMOLOGOUS DNA FOR STREPTOMYCIN RESISTANCE IN MICHIGAN APPLE ORCHARDS.
AUTHOR(S): SOBICZEWSKI P [Reprint author]; CHIOU C S; JONES A L
CORPORATE SOURCE: INST POMOL FLORICULTURE, 96-100 SKIERNIEWICE, POLAND
SOURCE: Plant Disease, (1991) Vol. 75, No. 11, pp. 1110-1113.
CODEN: PLDIDE. ISSN: 0191-2917.
DOCUMENT TYPE: Article
FILE SEGMENT: BA

LANGUAGE: ENGLISH
ENTRY DATE: Entered STN: 10 Dec 1991
Last Updated on STN: 6 Mar 1992

AB Streptomycin-resistant bacteria were recovered from leaves of apple (Malus domestica) and from leaves and stems of various weed species collected from six orchards in Michigan [USA] that had been treated with streptomycin recent years. Population of streptomycin-resistant bacteria ranged from 2.0 + 103 to 5.7 + 105 cfu per apple leaf and from 2.0 + 104 to 1.4 + 106 cfu per gram fresh weight of tissue from weed species. In DNA colony hybridization studies, 97% of 152 strains of streptomycin-resistant gram-negative bacteria contained DNA that hybridized with a 500-bp DNA probe associated with streptomycin resistance in Pseudomonas syringae pv. papulans. These bacteria included strains of P. syringae (several pathovars), P. **fluorescens**, P. aeruginosa, P. putida, Erwinia amylovora, E. herbicola Acinetobacter, Aeromonas, Flavobacterium, and a yellow-pigmented Pseudomonas sp. In contrast, DNA from 28 gram-positive bacteria (mostly yellow-pigmented Corynebacterium), three strains of E. herbicola, one strain of P. viridiflava, and on unidentified yellow gram-negative bacterium did not hybridize with the probe. In Southern hybridizations, there was restriction fragment length polymorphism in the SMP3 streptomycin-resistance region among the gram-negative bacteria isolated from apple orchards.

L24 ANSWER 14 OF 18 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN DUPLICATE 4
ACCESSION NUMBER: 1989:27531 BIOSIS
DOCUMENT NUMBER: PREV198987015531; BA87:15531
TITLE: ISOLATION AND CHARACTERIZATION OF A NONHETEROCYSTOUS CYANOBACTERIUM LYNGBYA-SP ISOLATE NO. 108 FOR LARGE-QUANTITY **HYDROGEN PRODUCTION.**
AUTHOR(S): KUWADA Y [Reprint author]; NAKATSUKASA M; OHTA Y
CORPORATE SOURCE: LAB MICROBIAL BIOCHEM, FAC APPLIED BIOL SCI, HIROSHIMA UNIV, SAIJYO-CHO, HIGASHIHIROSHIMA 724, JPN
SOURCE: Agricultural and Biological Chemistry, (1988) Vol. 52, No. 8, pp. 1923-1928.
CODEN: ABCHA6. ISSN: 0002-1369.
DOCUMENT TYPE: Article
FILE SEGMENT: BA
LANGUAGE: ENGLISH
ENTRY DATE: Entered STN: 20 Dec 1988
Last Updated on STN: 20 Dec 1988

AB Of 52 **algal cultures** isolated in the Seto Inland Sea area, one cyanobacterium produced large quantities of H2. This organisms, isolate 108, was a freshwater, nonheterocystous, ensheathed and filamentous cyanobacterium, and was morphologically identified as a Lyngbya species. The optimum conditions for **hydrogen production** by it were: pH, 6.5; temperature, 30° C; and light intensity, 1,000 lux under **fluorescent** light. Low concentration of potassium nitrate (0.05 g/l) and yeast extract (0.01%) stimulated its growth and **hydrogen production.** Of the mineral salts tested FeSO4 markedly stimulated the growth of isolate 108. The highest rate of **hydrogen production** was 124 mc/g cells/day. The carbohydrate content of cultures was decreased by 85%, during **hydrogen production.**

L24 ANSWER 15 OF 18 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN DUPLICATE 5
ACCESSION NUMBER: 1987:399823 BIOSIS
DOCUMENT NUMBER: PREV198784076003; BA84:76003

TITLE: **HYDROGEN PRODUCTION** BY A MIXED CULTURE OF A GREEN ALGA **CHLAMYDOMONAS**-REINHARDTII AND A PHOTOSYNTHETIC BACTERIUM RHODOSPIRILLUM-RUBRUM.
AUTHOR(S): MIYAMOTO K [Reprint author]; OHTA S; NAWA Y; MORI Y; MIURA Y
CORPORATE SOURCE: DEP BIOCHEM ENG, FAC PHARMACEUTICAL SCI, OSAKA UNIV, 1-6 YAMADAOKA, SUITA, OSAKA 565, JPN
SOURCE: Agricultural and Biological Chemistry, (1987) Vol. 51, No. 5, pp. 1319-1324.
CODEN: ABCHA6. ISSN: 0002-1369.
DOCUMENT TYPE: Article
FILE SEGMENT: BA
LANGUAGE: ENGLISH
ENTRY DATE: Entered STN: 18 Sep 1987
Last Updated on STN: 18 Sep 1987

AB An about 4-fold H2 evolution rate and a 5-fold H2 molar yield (mol H2/mol glucose) were obtained with a mixed culture of **Chlamydomonas** reinhardtii and Rhodosprillum rubrum, compared with in the case of an **algal culture** of C. reinhardtii alone. This increasing effect was due to the consumption of formate formed by C. reinhardtii; R. rubrum evolved hydrogen from formate via the formate hydrogen-lyase system under dark **anaerobic** (N2) conditions. Maximum H2 evolution by the mixed culture was observed with a rato of 8 : 2 (alga : bacterium) at a total cell concentration of above 0.6 mg dry wt/ml. Sustained H2 production with an alternating light/dark cycle in a membrane reactor, in which this alga and bacterium were cultured in separate compartments, was performed for one week.

L24 ANSWER 16 OF 18 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN DUPLICATE 6
ACCESSION NUMBER: 1984:262486 BIOSIS
DOCUMENT NUMBER: PREV198477095470; BA77:95470
TITLE: INTENSIVE CULTURE OF **CHLORELLA**-VULGARIS AA AS THE 2ND STAGE OF BIOLOGICAL PURIFICATION OF NITROGEN INDUSTRY WASTE WATERS.
AUTHOR(S): PRZYTOCKA-JUSIAK M [Reprint author]; DUSZOTA M; MATUSIAK K; MYCIELSKI R
CORPORATE SOURCE: DEP ENVIRON MICROBIOL, INST MICROBIOL, WARSAW UNIV, 18 KAROWA, 00-324 WARSAW, POLAND
SOURCE: Water Research, (1984) Vol. 18, No. 1, pp. 1-8.
CODEN: WATRAG. ISSN: 0043-1354.
DOCUMENT TYPE: Article
FILE SEGMENT: BA
LANGUAGE: ENGLISH

AB A method for the 2-stage removal of N from highly loaded nitrogenous wastewaters carrying varying proportions of NO3, NO2 and NH4 is presented. The method combines denitrification (stage 1 of purification) and intensive **algal culture** (stage 2 of purification). Denitrification in an **anaerobic** packed bed reactor removed all the oxidized forms of N from the wastes enriched in methanol and P. NH4 remaining in the denitrified wastewaters was removed by intensive culture of algae. The use of this method resulted in 94.0-99.9% removal of N from the wastes. The application of the proposed methods is limited by the concentration of NH4-N in the wastewaters.

L24 ANSWER 17 OF 18 BIOSIS COPYRIGHT (c) 2007 The Thomson Corporation on STN
ACCESSION NUMBER: 1983:184978 BIOSIS
DOCUMENT NUMBER: PREV198375034978; BA75:34978
TITLE: HYGIENIC AND MICROBIOLOGICAL INFLUENCES EXERTED ON NATURAL

WATER BIOTOPES BY ALGAE AND THE GROWTH OF WATER PLANTS 1. ANTI BACTERIAL PROPERTIES OF 3 WATER ALGAE HYDRODICTYON-RETICULATUM **CHLORELLA**-VULGARIS APHANOTHECE-NIDULANS IN-VITRO.

AUTHOR(S): GRAEF W [Reprint author]; BAIER W
CORPORATE SOURCE: INSTITUT FUER UMWELTHYGIENE UND PRAEVENTIVMEDIZIN, WASSERTURMSTR 5, D-8520 ERLANGEN

SOURCE: Zentralblatt fuer Bakteriologie Mikrobiologie und Hygiene Abt 1 Originale B Hygiene Umwelthygiene Krankenhaushygiene Arbeitshygiene Praeventive Medizin, (1981) Vol. 174, No. 5, pp. 421-442.
CODEN: ZAOMDC. ISSN: 0174-3015.
DOCUMENT TYPE: Article
FILE SEGMENT: BA
LANGUAGE: GERMAN

AB The growth-inhibiting behavior of abacterial, liquid pure cultures of 3 water algae (H. reticulatum, C. vulgaris, A. nidulans), which were made to grow profusely in special culture containers under exposure to light and ventilation, was examined during a period of contact of 4 days both in the light and in the dark. Subjected to the test were the 5 pathogenic species Staphylococcus aureus, Klebsiella aerogenes, Pseudomonas aeruginosa, Salmonella typhimurium and Candida albicans and the 5 bacterial contamination indicators Escherichia coli, Streptococcus faecalis, Enterobacter aerogenes, Staphylococcus epidermidis and Bacillus subtilis. H. reticulatum and A. nidulans exerted a strong antibacterial effect; C. vulgaris gave no indication of a bacterial growth-inhibting effect. This antibiosis was linked with the assimilative activity of the **algal cultures**, as in the dark no antibacterial action was discernible.

L24 ANSWER 18 OF 18 EMBASE

ACCESSION NUMBER: 79163587 EMBASE
DOCUMENT NUMBER: 1979163587

TITLE: Settling rates of algae from wastewater lagoons.

AUTHOR: Stutz-McDonald S.E.; Williamson K.J.
CORPORATE SOURCE: United States

SOURCE: J. ENVIRON. ENG. DIV. AM. SOC. CIV. ENG., (1979) Vol. 105, No. EE2, pp. 273-282. .
CODEN: JEEGAV
COUNTRY: United States
DOCUMENT TYPE: Journal
FILE SEGMENT: 046 Environmental Health and Pollution Control
LANGUAGE: English

AB The settling rates of algae are considered to be a controlling factor in the operation of rock filters that are used for the removal of algae from lagoon effluents. The settling rates of Scenendesmus acuminatus, **Chlorella** vulgaris and Microcystis aeruginosa were measured for various temperatures, for dark aerobic and anoxic incubation, and for various mixture ratios of the three species. Of all variables tested temperature seems to have the largest influence on settling rates. Settling rates in m per day decreased from 0.262 at 21°C to 0.094 at 5°C for S. acuminatus and from 0.128 at 21°C to 0.016 at 5°C for M. aeruginosa. Incubation under either aerobic or **anaerobic** conditions for up to 15 days does not significantly alter the algal settling rates. The settling rate of a mixed **algal culture** can be estimated from the known fraction and settling rate of each algal species present.